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ANALYSIS OF THE ANATOMY OF A MODERN SOVIET FFG-FRIGATE  
THE KRIVAK II CLASS(U) NAVAL INTELLIGENCE SUPPORT  
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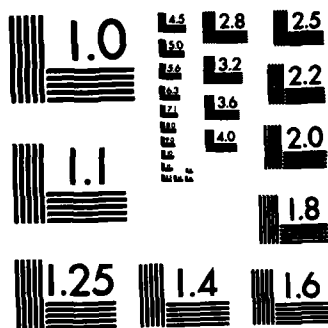
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The KRIVAK II Class

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## THE KRIVAK II CLASS

[Breyer, Siegfried: Soldat und Technik, September 1982, D 6323 E, pp. 501 - 511, 5 pages: German]

Eleven years ago at the beginning of June 1971 a new type of a larger Soviet surface combatant made its debut: The KRIVAK Class, whose units were at that time designated by NATO as DDGM = Destroyer, Guided Missile, and by the Bundesmarine (FRG Navy) as FK-Zerstörer (Guided Missile Destroyer), while it was listed by the Soviets as BPK = Bolshoye Protivodohnyye Korabl = large anti-submarine ship. When from 1977/78 a change was made in the Soviet nomenclature that these units were redesignated as SKR = Storozhevyye Korabl: escort ships (and in this regard the units experienced a certain "degradation", NATO also responded with a downgrading and then designated these units as FFGSP = Frigates, Guided Missile SUM/Point Defense. The significance of this Soviet revision in the nomenclature became apparent only some years later, when new classes of considerably enlarged surface combat units entered service, which are intended for long-term deployment. Those units which previously had destroyer standards in the Soviet Navy have been enlarged to cruiser size, and the cruisers have increased to the dimensions of previous battleships, so that as a result a distinction might have to have been made between the large anti-submarine ships (UDALOY Class) and large guided missile ships (SOVREMENNY Class) and the smallest of the large anti-submarine ships to date - those of the KRIVAK Class - from the perspective and intent of a navy which was expanding and is intended for a permanent oceanic presence. Despite their designation in the Soviet Navy as "escort ships" and similarly despite the categorization in NATO as "FFGSP-Frigates", upon closer inspection the KRIVAK Class appears to be the development of typical destroyers, but this analysis on the basis of current analysis requires qualification. The determinative factor for the previous designation as "destroyer" was probably the erroneous estimation of the main guided missile system, to which initially a ship-to-ship capability had been assigned; this missile system was listed with the NATO code designation "SS-N-10". Therefore the primary mission of this new class appeared to be operation against surface ships, on the basis of this analysis the assignment to the destroyer category - of the modern contemporary type - could be justified. Only after quite some time (and even then not with complete acceptance) it had to be realized that this class of ships is not equipped primarily for combatting surface units, but that its primary mission is actually ASW (Anti-Submarine Warfare), and that it is equipped not with the previously assumed SS-N-10 ship-to-ship missile, but with the SS-N-14 weapons system, which is designed for the anti-submarine role. Instead of a destroyer in contemporary configuration, this class is rather a ship which should be assigned to the category of escort ship. On this basis it can be noted from what epoch the type conception and design of this KRIVAK Class derives: not from the era of the "anti-aircraft carrier" concept, but from the anti-POLARIS era, which succeeded it.

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\*Numbers in the right margin indicate pagination in the original text

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The KRIVAK Class is currently subdivided into the KRIVAK I variant as /501 its original version and into the further developed KRIVAK II version. The KRIVAK I Class appears to be complete with twenty units after a construction period of ca. thirteen years, and to date there are eleven units of the KRIVAK II version. Construction of the KRIVAK II was initiated in approximately 1973, and the first unit entered service in 1976. While the construction of all KRIVAK I units was distributed over three shipyards - beginning in East Prussian Königsberg (current Soviet designation "Kaliningrad" at the "Yantar Shipyard"), then in the Black Sea at the "Zaliv Shipyard" in Kerch/Kamysch-Burun, and then at the Leningrad Zhdanov Shipyard, the construction of the KRIVAK II units has been restricted to the Königsberg shipyard.

Upon closer examination (and in most regards this also applies for the original KRIVAK I version), it is apparent how well this Class is adapted to the requirements of coordinated ASW-operations. In this following discussions the attempt will therefore be made to develop a perspective upon their design and thereby to make conclusions in regard to their internal configuration - so to say in regard to their "anatomy".

#### SHIP HULL

In analyzing the ship hull, it can be noted that the requirement for a high degree of seaworthiness was assigned a particularly high degree of priority: For the first time in Soviet naval design for ships of this size the decision was made for a long forecastle deck with a short stern step - the ratio of both to each other is ca. 3 : 1. At the bow the freeboard is somewhat more than 7 meters, at the center of the ship it is 5 meters and at the stern it is 2.5 meters. The average molded depth is 7.5 meters up to the main deck and approximately 10 meters to the forecastle deck. From the main deck the ship hull descends in the center third of the ship downwards - this makes the expansion of the knuckled hull form (chine-type frames) which can be noted there apparent, so that on the basis of the hull width to be assumed in the design water line (DWL) a length-to-beam ratio can be deduced, which should be at ca. 8.4, a dimension which is characteristic for fast ships. The very projecting foreship terminates with a slightly crescent foresteven, whose pronounced indentation (ca. 8 m) suggests bow sonar dome. At the stern the hull terminates in the usual angled transom stern. The rear third of the hull manifests reinforcement beams. The purpose of these beams might be to counter stresses on the structural members (and possibly moreover of the VDS-system) caused by vibration from the propulsive system, and therefore might well be intended to

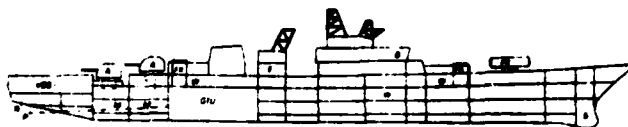


Fig. 1: Longitudinal section of an FFGSP-frigate of the KRIVAK II Class with assumed internal compartmentation.

A = Artillery. B = Bridge, E = Electrical system, FK = Guided missile system. GTU = Gas turbines, M = Ammunition, P = Propeller, R = Rudder, W = Crew accommodations, VDS = Variable Depth Sonar.

enhance the structural strength of the hull. It can be assumed with a fair degree of certainty that fin stabilizers are provided to compensate rolling and to provide the most stable possible weapons platform.

# The Ships of The KRIVAK Class

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Hull No	Name	Building Dates	Assignment
		Shipyard: All built at Yantar Shipyard Kalinengrad	
1	RETIVY (The Wild One)	1974-76	Northern Fleet
2	REZKY (The Sharp)	1974-76	Pacific Fleet
3	RAZYTELNY (The Conspicuous)	1975-77	Black Sea Fleet
4	GROZYASHSCHY (The Threatening)	1976-78	Pacific Fleet
5	NEUKROTIMY (The Intrepid)	1976-78	Baltic Fleet
6	BESSMENNY (The Resolute)	1976-78	Northern Fleet
7	GROMKY (The Strong)	1977-79	Northern Fleet
8	GRODELIVY (The Proud)	1977-79	Pacific Fleet
9	RYANY (The Robust)	1978-80	Pacific Fleet
10	REVNOSTNY (The Eager)	1978-80	Pacific Fleet
11	PYTLIVY (The Daring)	1979-81	?

Based upon the external configuration four decks inside the hull would have to be assumed. In this regard it is not certain whether or not a double bottom is provided. Similarly on the basis of the external design it can be concluded that there is an internal compartmentation, as illustrated in Fig. 1. The subdivision would provide approximately fifteen water-tight compartments, which would be commensurate the the usual standards.

As differentiated from the KRIVAK I, in the KRIVAK II the aftership is configured slightly differently: The stern step is shorter by 3.5 meters; however, the forecastle step is extended by the same distance astern, so that the same total length as in the KRIVAK I is retained. Originally it had been erroneously assumed that the KRIVAK II Class had a slightly greater length. The reason for this modification in design was the artillery armament, for which somewhat more room might have been necessary than was the case with the KRIVAK I Class. If this assumption is valid, then other space would have been sacrificed, because, as mentioned, there was no enlargement.

## PROPULSION AND SHIP OPERATION

The KRIVAK Class - including the KRIVAK II variant - is the second type of larger surface combatant exclusively with gas turbine propulsion, which Soviet naval construction has produced to date. This development had begun with the designed based on the KASHIN Class in the late 1950's, whose two-shaft system is driven by four gas turbines of the same power. In addition four gas turbines of lesser power are provided, which provide the power for requirements for electrical power for the ship operation, the electronics and the weapons systems. The four propulsion gas turbines provide a total power of 70,610 kW (= 96,000 HP) for a speed of at least 35 kn. The two-shaft system provided for the KRIVAK Class would probably be technologically similar to that of the KASHIN Class, but with the difference that separate, i.e., gas turbines of different power are provided for high speed and for cruising, of which the high-speed turbines deliver 2 x 17,895 kW (= 48,640 HP) and the cruise turbines deliver 2 x 8,950 (= 24,300 HP, together ca. 54,000 kW or 73,000 HP, which corresponds to a

total of 76 percent of the power generated in the KASHIN Class. Thereby the KRIVAK class, which are lighter by some 1,000 tons, reach ca. 32 kn at operational displacement, and are only slightly slower than the KASHIN Class, which make ca. 35 kn. Doubtless the KRIVAK propulsion system has the advantage of less space requirement; the exhaust uptakes, which are in a pronounced astern position, suggests the spatial extent of the propulsion system: on this basis the two main gas turbines would be located side by side in the center of the ship and the cruising turbines behind them, all of them in a compartment near the stern, which again provides the advantage of shorter propeller shafts. Two rudders are probably provided.

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Whereas in the KASHIN Class there is a "pure" gas turbine system, the propulsion system in the KRIVAK Class is probably a typical CIGOG/COGAG system, most likely in very compact design. It appears however that the Soviets have not yet succeeded in the KRIVAK II Class in reducing the fuel consumption in the gas turbines, which is considerably higher than in Western gas turbine designs, and on this basis the conclusion might be drawn that the endurance of these ships is not very economical. One possibility for increasing the sea endurance slightly would be the technique used in the KASHIN Class of operating with only one shaft, and letting the other shaft run uncoupled in the wake. However, this is only an assumption with reference to the KRIVAK Class.

There is not information available in regard to the power plant which is used to generate electrical power, so no statement can be made in this regard.

#### ARMAMENT

The units of the KRIVAK II Class have five weapons systems: three for ASW, one for engaging air targets and another as conventional artillery. The SS-N-14 guided missile weapons systems is regarded as the main armament. The four "SILEX" missiles carried are in cylindrical starters ca. 9 meters long and with a internal diameter of 1.6 meters, which are combined in a quadruple group and can be turned 360° on a pedestal with a diameter of not quite 3 meters and can be elevated to a maximum of 20°. In the front and rear these starters have lid covers, which are open from the top for loading and starting.

The SILEX is an aerodynamic missile ca. 8 meters long of somewhat over 0.8 m cell diameter with a solid fuel engine and with two discarding solid fuel boosters. Their short stub wings are folded inside the starter and are deployed automatically to ca. 2.3 m upon release from the starter. As the "payload" this missile carries an AS-torpedo, which is ejected at a pre-calculated position, floats down on a parachute to the surface of the water, separates automatically from the parachute and assumes a search pattern, for which purpose it is equipped with a homing head (acoustically activated?).

The start weight of the SILEX is estimated at ca. 2,500 kg; its maximum speed is just below MACH 1, and the range might be ca. 30 sm. The SILEX performs its flight path with radar guide beam assistance; it appears to change its altitude constantly according to a specific program, whereby it is probably capable of underflying hostile radar detection for at least a part of its trajectory.

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Fig. 2: BESSENNY, photographed in the Norwegian Sea in the Fall of 1981



The SILEX load is limited to four missiles per ship. There is no re-load capability in action, because there does not appear to be any room for reserve missiles, and in addition re-loading with on-board facilities alone would cause considerable problems. At base re-load is effected with a special loading platform (this is carried on board only in special situations - for example, on deployment cruises or change of station). For this loading platform on both sides just behind the quadruple starter group on deck guide rings each of ca. 3 meter diameter are provided on which the loading platform and with which it can be brought into the corresponding loading position for the starter group turned towards it, whereby the insertion of the missiles can be performed probably without major difficulty on the horizontal plane. /503

The "limited surface target capability" which is assigned variously to the SS-N-14 guided missile weapons systems to date does not appear to be confirmed. Such a capability could however be realized - at least theoretically - if instead of an AS-torpedo a surface-target torpedo could be inserted as payload into the missile, whereby the surface-target torpedo would be deployed in the same manner as the AS-torpedo. The second guided missile weapons system - which has the NATO code designation SA-N-4 - is exclusively of a defensive nature and is used for close-range and close-in defense against air attacks, whereby in addition to low-flying manned aircraft and/or helicopters "sea skimmer" missiles are included, and it might therefore be qualified as an anti-missile system. This is a "navalized" version of the SA-8, the mobile army anti-aircraft system, which has been in service with Soviet ground forces for several years. The single-stage solid-fuel missile with the NATO codename GECKO is used, which has a length of 3.2 m and a cell diameter of 0.64 m. Its warhead is probably a ca. 20 kg charge of conventional explosive. The GECKO, which has a start weight of ca. 200 kg, attains a speed of MACH 2.5, and has a ranged which is listed variously in different sources, "Flottes de Combat 1982" states a range of 12,000 m, including the intercept zone, which begins at 60 m and ends at 900 m. The control is provided in the initial flight phase by radar guide beam, thereafter probably by radio control.

The KRIVAK Class has two SA-N-4 systems, each of which consists of a cylindrical silo magazine with a retractable double starter. This silo housing is today the beginning of the attempt for below-decks guided missile systems, which are installed in the latest Soviet surface combatants; with this principle considerable advantages are gained, if it is considered that extensive protection from the effects of weather are obtained thereby, maintenance can be performed independent of the weather and an optimum degree of operational availability can be maintained. /504

The SA-N-4 silo magazine has an approximate height of 5 meters (which corresponds to ca. two deck heights) and a diameter of ca. 4 meters. Its base in the KRIVAK Class is on the main deck. It has a capacity of twenty missiles, which are arranged in vertical position around the inner wall of the silo and from there can be moved so far to the center of the silo, that they engage the exactly vertically position arms of the retracted double starter and after it has been elevated are ready for starting. The double starter is mounted on a platform of ca. 2.5 meter diameter, which can move as a type of lifting stage at the level of the inside of the silo, which can be effected only with vertically positioned starter arms. Above the silo

is closed by a two-part protective cover. For releasing the starter both halves of the cover are shifted approximately half a meter towards the outside. In both systems devices are provided, which deflect the exhaust blast of the missile at the moment of its start so that other systems are not endangered.

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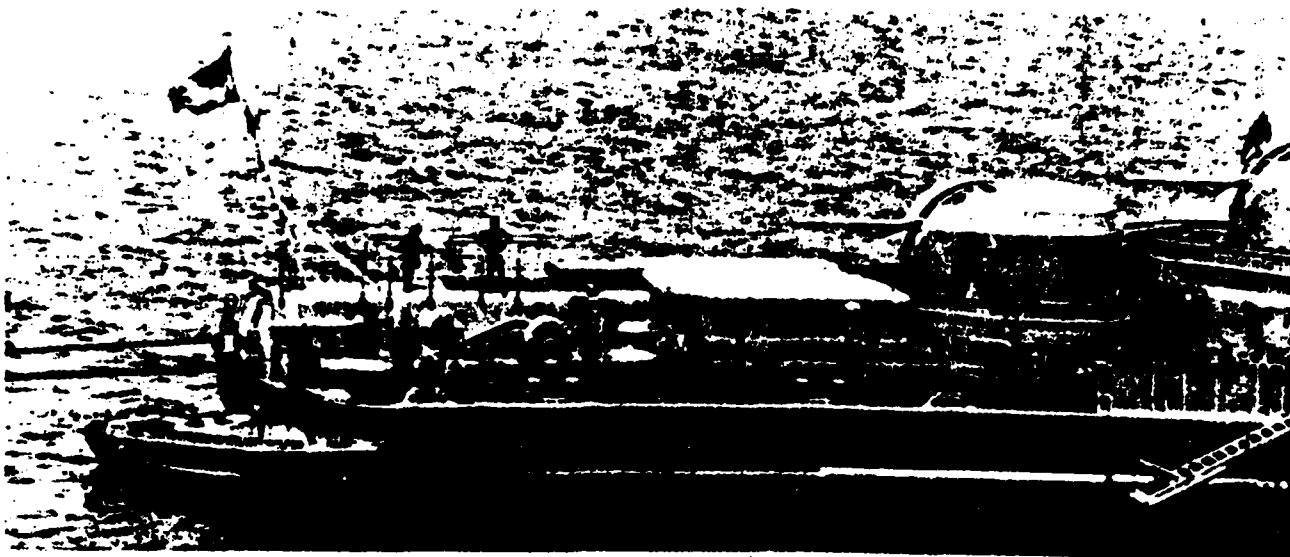


Fig. 3: The stern of the GROZYASHSCHY with the two new 100 mm turrets and the modified VDS-chamber.

The artillery armament of the KRIVAK II Class differs considerably from that of the KRIVAK I Class, in which the armament consists of four 76 mm L/52 guns, a model which was introduced at the beginning of the 1960's and is installed on many Soviet ships. These four 76 mm guns have been replaced on the KRIVAK II Class by two 100 mm guns of a model which was introduced and became operational in the mid-1970's. This is very likely a DP-gun, with which both sea and air targets can be engaged. The tube manifests the typical features of liquid cooling, which indicates a high rate of fire. Generally this is estimated at forty rounds per minute. Automatic loading would be necessary. According to all information available to date - which appears to be based exclusively upon estimates - the maximum range is estimated at 15,000 m and the effective range at 8,000 m. The turret-shaped spherical cap over the gun does not appear to be made of plastic, as is the case in more recent Western turrets, but of steel plate. The slot-shaped indentation in the front center of the turret indicates that the elevation range exceeds 70 to 75°. The installation of the rear 100 mm turret in the KRIVAK II Class is unusual, because it has a considerably high firing level than is the case in the preceding KRIVAK I Class. This was probably caused by the requirements for ammunition supply, probably because it requires a certain minimum height. As opposed to this, the forward (Y) 100 mm turret is installed at the same height as in the KRIVAK I Class, and as a result that its tube intersects with the deck of the following, so that it can overshoot the deck with safety only with +5° tube elevation, but this situation would occur only very rarely. The two triple 533 mm torpedo tubes, which are located amidships on the side decks, can each be turned and fire both conventional surface-target torpedoes and probably also 400 mm AS-torpedoes. Whether or not additional torpedoes are carried as reserve in addition to those in the tubes is not certain. The possibility for this would certainly be available, for example in the lower bridge superstructures, from whose port rear side a track leads. This could be an indication that the in space behind it a torpedo regulation facility is located. Several

reserve torpedoes could be stored in it quite easily. There would in any event be a necessity for such storage, if both surface-target torpedoes and AS-torpedoes are carried, in order to accommodate both alternative situations. A pair of tracks which is located on the port side deck meets in the suspected torpedo adjustment shop the track reserved for the torpedoes. Small lorries presumably run on this on which torpedoes being taken on board can be placed and then can be brought to the tubes for reloading.

The third and last AS-weapons system - two RBU-6000 rocket launchers (previous NATO designation MBU 2500A) - is located directly before the bridge complex slightly elevated behind the front SA-N-4 system. Both are separated from each other by a perforated longitudinal wall, which serves as a blast deflector, when the rocket groups fire in the abeam position.

Each of these groups consists of 2 x 6 tubes each 1.6 m long with 250 mm diameter, which are arranged in a quarter-circle arc superimposed over each other, which are firmly attached to each other and have an elevating range from 0 to +50°. Non-guided rockets are fired from them up to a range of 6,000 meters. These rockets are estimated to have a weight of 90 kg, of which the warhead would consist of 55 kg. The reloading of the rockets is performed automatically from the magazine located directly below the starter group, for which purpose the tube (barrel) group must be erected until it is exactly vertical and the rockets can be inserted from below. Firing is effected in paired sequences.

#### ELECTRONICS

According to Western opinion combatants like the KRIVAK Class do not have such sophisticated control systems as is the case in many comparable Western ship types. This is generally due to the fact that such units are controlled by command centers located ashore. If this is the case, then the KRIVAK Class must be a prime example of this, because they neither manifest such features externally for such systems nor would they have room for such systems.

One of the most conspicuous electronic features of all units of the KRIVAK Class is the LONG FOLD lattice mast inclined 10° to the rear behind the main mast. It carries several antenna systems, a HIGH POLE B cage antenna of the IFF-system, below it a HIGH POP frame antenna for RT-transmission and then another cage-type antenna, which is also used for RT-purposes, and in addition a CROSS LOOP direction finding loop antenna and several other sensors and effectors of smaller design. On the mainmast ca. 20 meters above the waterline a long-range air/sea omni-directional HEAD NET C radar operating on E and F frequency bands is located, whose detection range is ca. 20 sm for surface ships and ca. 60 to 70 sm in the case of larger aircraft. The antenna system consists of two ORANGE PEEL parabolic reflectors, which are only 6 m long and 1.5 m wide, which are suspended opposed to each other on a 2.50 m column, one in exactly horizontal orientation, the other tilted between 28° and 30°, probably because it is used as a vertical range finder. The horn antennas of the two reflectors, which protrude very conspicuously below, are particularly noticeable. The turning radius of this antenna system is ca. 7.30 m. In addition to this radar the KRIVAK Class also has two navigation radar systems available, specifically one the DON KAY (it is located on the cross-tree of the mainmast below the HEAD NET C radar) and another DON KAY-2 on a projecting bracket above the front of the bridge.

The DON KAY radar, which was first observed in 1967, has a ca. 2 meter long and 0.5 meter wide closed parabolic reflector, carried by a fork-shaped frame, which is swivel-mounted on a pedestal housing, from which a horn antenna projects only slightly forward. The turning radius of this radar has a diameter of 2 meters. Its detection range is estimated as being ca. 15 to 17 sm. More recent units have in place of the DON KAY radar a PALM FROND radar, which appears to be developing into the standard navigation on Soviet ships. This model, which has been known since the mid-1970's, insofar as the design and antenna is concerned, is similar to the DON KAY, but its reflector has a more elliptical basic surface. It operates on the I-band. /511

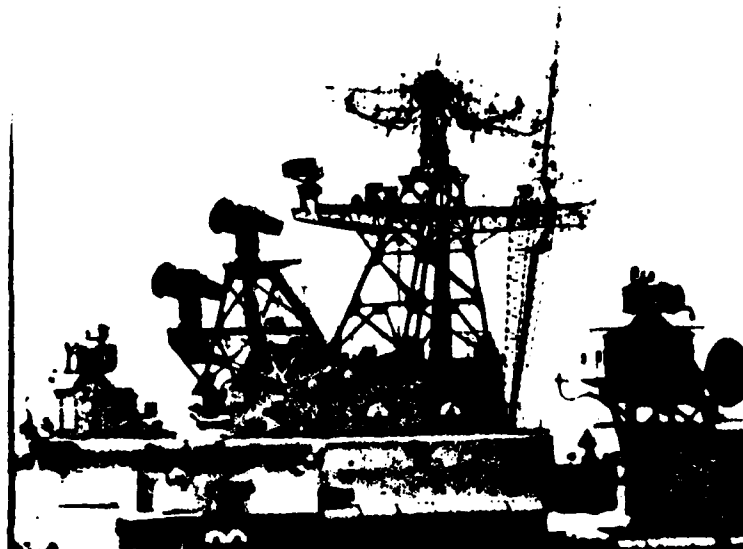


Fig. 4: View of the bridge superstructures. From left to right there can be noted: one of the two RBU-6000 AS-rocket launcher groups, then the POP GROUP fire control radar of the forward SA-N-4 guided missile weapons system, above it the two EYE BOWL fire control radars of the SS-N-14 guided missile weapons system, then the DON KAY sea surveillance radar and on the mast head the HEAD NET C air search omni-directional radar. Behind it there is a LONG FOLD lattice mast with additional antennas. Somewhat lower behind it the rear POP GROUP guided missile fire control radar and on the far right edge of the photo the KITE SCREEN artillery fire control radar.

In regard to the DON-2 radar, which operates on the H and I frequency bands and which has been in service since the beginning of the 1960's, it is a slot radiator ca. 2.7 meters long and ca. 12 cm edge width, which is mounted on a 1.25 meter wide bracket, which again is mounted on a box frame. The height of the system is not quite 1 meter; there are no figures available for its range.

The SILEX missiles of the SS-N-14 weapons system are controlled by means of two radar systems (NATO code name EYE BOWL), which operate on the F frequency band. The two radars are located on the low four-leg binder mast mounted on the bridge at a height of not quite 17 meters above the waterline. In regard to these on the basis of their external shape they are designs which are known from various artillery fire control radars: three adjacent box-shaped elements are on a slender pedestal; on their front side there is a parabolic reflector of more than 1 meter diameter with a rod radiator

exactly in front of the center, and behind they have two parallel stabilizer fins, which as differentiated from other comparable systems are not stayed. The entire radar system is ca. 1.8 meters high and has a turning radius of 2.5 meter diameter. /511

The fire control radars for the SA-N-4 guided missile weapons system, which operate on the F, H, I and J-frequency bands - their NATO code name is POP GROUP - are located above the bridge at a height of 12 meters and on a quadrupod mast at the center of the ship at a height of 14 meters above the waterline. The POP GROUP radar consists of a cube-shaped solidly built lower cabin (in which the operating personnel are probably located) of ca. 1.5 m edge length, and of a smaller rotating housing mounted on top of the cabin ca. 1 meter high, on whose front side two differently sized dish reflectors are installed - the larger dish has a diameter of ca. 1 meter, the smaller only half as large; they are located side by side. Whether or not this upper part can be oriented for elevation cannot be determined from the photographic material available to us, but this possibility can be assumed. On its roof in addition a ca. 2 meter wide parabolic segment reflector mounted, which presumably rotates independently of the radar.

As the artillery fire control system a presumably fully stabilized KITTSCHREITCH system is provided, which is quite similar to the EYE BOWL radar but is considerably larger than it is. Here as well a somewhat cylindrical column is used as the rotating pedestal, on it the box-shaped housing which is oriented in elevation with a parabolic reflector of somewhat more than 2 m diameter (with a pot radiator held exactly in the center by two brackets against it) and this is equipped with two stabilizer fins which are stayed and point to the rear. The entire system is a good 3.30 meters high and has a turning radius of almost 5 meters.

In addition, 10 whip antennas arranged in pairs of various length and a SPRAT STAR antenna on the bridge complex can be cited. Those systems which are located on both sides below the main mast are BELL SQUAT systems which have an EW-function and the same applies for the BELL SHOUD systems on both sides of the front edge of the bridge.

The KRIVAK Class have in addition as other EW-systems four chaff dispensers, which each have sixteen rockets. These are in boxes ca. 1 meter long, 0.7 m high and 0.5 m wide and are mounted angled on the outer wall of the superstructure deck at ca. 10° at the rear SA-N-4 system, whereby the forward chaff dispensers fire to the front and the rear dispensers fire on the beam.

#### SONAR SYSTEM

The KRIVAK Class has sonar systems: this includes both a VDS towed sonar array, which operates in the frequency range of 10.5 kHz and a bow sonar which operates in the frequency range 2 to 4 and 8 to 9 kHz.

The VDS (Variable Depth Sonar) is located in a ca. 3 meter high chamber, which protrudes above the upper deck by ca. 1.8 meters, and to accommodate this the upper deck is cut in from the middle of the stern to a width of 2.8 meters. The VDS hangs on a bridle which is also located in the chamber and which can presumably be moved and is unwound over this as soon as it is released from the chamber. The chamber opening is closed by a flap lock. Apparently a bulge design was provided for the bow sonar.

This is suggested by the very indented (constricted) foresteven, in which the bow hawse hoes are located almost at the furthest end. This configuration is intended to prevent damage to the sonar dome (bulge) when the anchor is dropped and when the ship swings around the anchor chain. In the general opinion of Western experts sonar systems built by the Soviets do not yet have the large ranges, which are characteristic for Western systems - particularly for American systems.

(Article continued in next edition)

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